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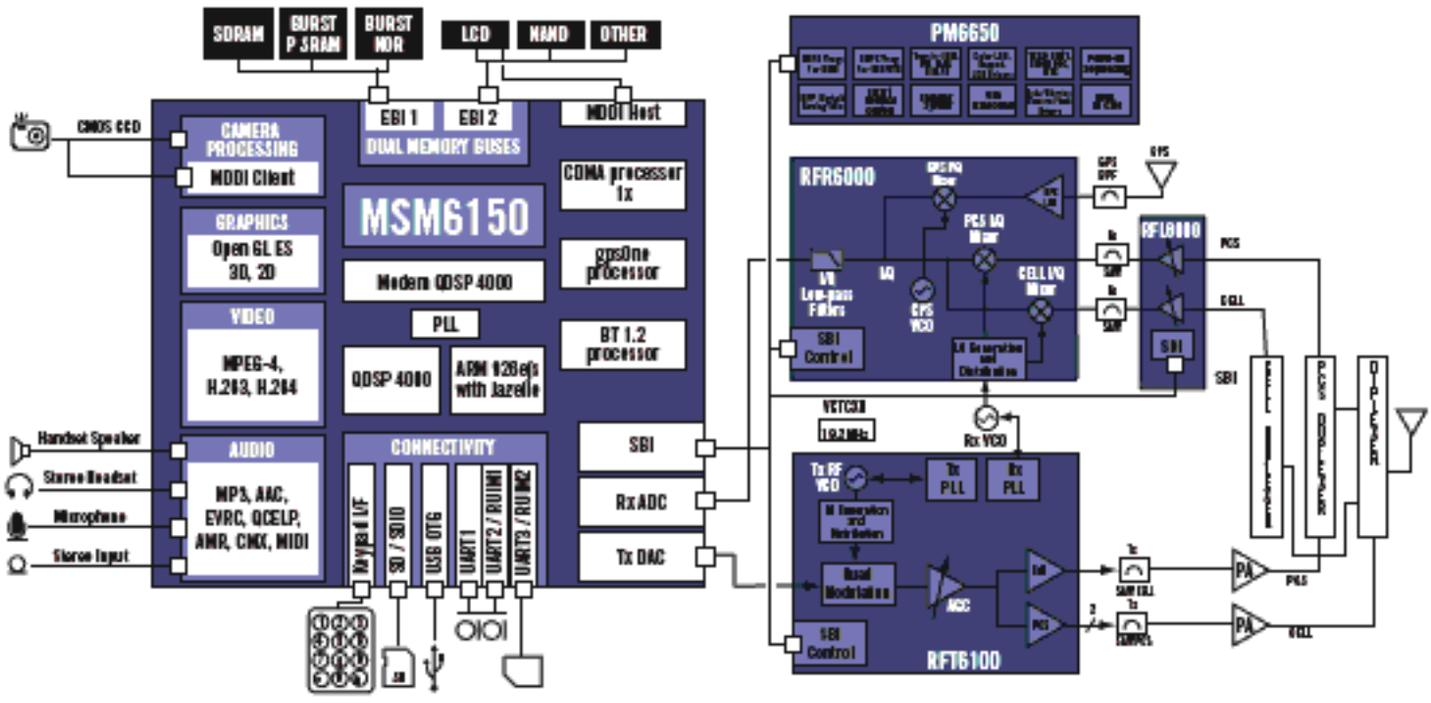
MSM6150™ CHIPSET SOLUTION



MSM6150 Chipset Architecture Using QCT's radioOne Zero Intermediate Frequency (ZIF)

MSM6150 Chipset Solution

The global expansion of 3G CDMA2000® 1X networks has extended the availability of high-speed, wireless data access. With increased accessibility has come increased demand for wireless devices that function as camera, camcorder, personal video player, MP3 audio player, gaming console and phone. To efficiently support next-generation data speeds and functionality, wireless devices must integrate applications processors with high-performance modems.

To address this growing opportunity, QUALCOMM CDMA Technologies (QCT) developed the MSM6150™ Mobile Station Modem™ (MSM™) chipset and system software solution.

The MSM6150 solution integrates powerful applications processors into QUALCOMM's market-proven wireless modem, offering increased processing capacity combined with lower power consumption. With the MSM6150 chipset solution, handset manufacturers can design sleek wireless devices that boast the industry's most advanced image quality and resolution to provide enhanced 3D animation, gaming, streaming video, videoconferencing and more.

QUALCOMM's MSM6150 solution offers significantly increased processing speeds, higher resolution video and graphics and extended usage times for gaming and video applications — all on a single chip. This single-chip solution eliminates the need for a separate applications processor, decreasing parts count, reducing bill-of-materials (BOM) costs and supporting the development of ultra-compact devices.

MSM6150 Chipset Solution Benefits

- Integrates dedicated hardware cores into the MSM which eliminates the need for multimedia co-processors — offers superior image quality and resolution for mobile devices and extended application time
- Enables impressive, user-compelling 3D graphics, multimedia, animation and video
- Provides longer run time for mobile devices over other industry solutions that use companion processors
- Provides superior quality video and graphics with Quarter Video Graphics Array (QVGA) resolution, a fourfold improvement over Quarter Common Intermediate Format (QCIF)
- Offers a higher degree of integration (digital and analog functions on a single chip) and dedicated hardware cores, which decrease power consumption while increasing power and quality
- Eliminates the need for Intermediate Frequency (IF) components, decreasing printed-circuit-board area and reducing time-to-market development and BOM costs
- Enables a wide variety of location-based services and applications, including points of interest, personal navigation and friend finder
- Provides dedicated support for all market-leading codecs and other multimedia formats on a single platform to support operator deployments around the world

MSM6150™ CHIPSET SOLUTION

MSM6150 Device Description

The MSM6150 device integrates the ARM926EJ-S™ processor, offering the ARM® Jazelle™ Java® hardware accelerator; two low-power, high-performance QDSP4000™ digital signal processor (DSP) cores; hardware acceleration for video, imaging and graphics; and a wideband stereo codec to support enhanced digital audio applications. The hardware acceleration eliminates the need for the multimedia companion processors normally required for video and audio-based applications that support MP3 music files, a MIDI synthesizer, video and still-image record and playback and 2D/3D graphics functions. By removing the need for costly applications co-processors and memory subsystems, the MSM6150 solution reduces BOM costs and increases standby and talk times. The MSM6150 solution integrates both digital and analog functions into a single chip.

The MSM6150 system solution consists of the MSM6150 baseband processor, complete with CDMA2000 1X/CDMA2000 protocol stack and multimedia system software. The MSM6150 interfaces with a variety of radio frequency (RF) system solutions supporting quad-mode (RFL6000™, RFR6000™, RFT6100™) terminals and cost optimized cellular only (RFR6120™, RFR6125™, RFT6120™) terminals. The baseband and RF chipsets are supported by QUALCOMM's powerOne™ series PM6650™ power management device.

MSM6150 Device Features

- CDMA2000 1X support (Revision 0 and A)
- High-performance ARM926EJ-S microprocessor core with memory management unit (MMU)
- ARM Jazelle Java hardware acceleration for faster Java-based games and other applets
- QDSP4000 high-performance DSP cores
- 72-polyphony MIDI wavetable synthesizer for high-quality music playback through the MSM6150 integrated wideband codec
- Quarter Video Graphics Array (QVGA) and Common Intermediate Format (CIF) resolutions for LCD
- Video telephony at 15 frames per second (fps), CIF resolution
- Video encode at 15 fps CIF for camcorder capability
- Video decode at 30 fps CIF resolution, streaming or offline
- Dedicated support for market-leading codecs, such as MPEG-4, H.263, H.264 and other multimedia formats to support operator deployments around the world
- High-quality digital camera processing, supporting CCD or CMOS image sensors up to 4.0 megapixel
- Advanced 2D/3D graphics support for more realistic game play and enhanced user interfaces
- High-speed, serial mobile display digital interface (MDDI), which optimizes the interconnection cost between the MSM and the LCD panel
- Integrated four-bit secure digital (SD) controller for SD and mini SD cards
- Integrated Bluetooth® 1.2 baseband processor for wireless connectivity to peripherals
- Integrated WAP 2.0-compliant browser with support for multimedia message service (MMS)-based applications
- Integrated JPEG encoder/decoder for content creation and MMS applications
- Integrated stereo (44.1 kHz and 48 kHz) wideband codec capable of CD-quality playback
- Enhanced memory support for NAND, burst mode NOR, SDRAM and burst mode PSRAM
- PureVoice® voice recognition (VR), including speaker-independent digit dialing
- Universal serial bus (USB) On-the-Go (OTG) functionality
- Removable user identity module (R-UIM) and subscriber identity module (SIM) card interface
- Advanced 409-pin 0.5 mm pitch CSP packaging technology (14 mm x 14 mm)

radioOne Technology

As with all members of the MSM6xxx™ family of chipset solutions, the MSM6150 solution features QUALCOMM's radioOne® Zero Intermediate Frequency (ZIF) architecture, which eliminates the need for Intermediate Frequency (IF) components. With radioOne technology, the MSM6150 chipset requires less printed-circuit-board area than previous generations and reduces time-to-market development and BOM costs.

RFL6000 Device Description

Integrated into the RFL6000 device are two low noise amplifiers (LNA): a cellular LNA and PCS LNA.

Operating modes — Sleep, Rx and Rx/Tx — as well as LNA bias currents, are all automatically adjusted via software to minimize DC power consumption. Depending on handset status, the LNA bias current adjusts automatically to meet RF performance requirements with minimal power consumption.

The device is fabricated using a SiGe BiCMOS process, which is suited for high performance RF circuits. The RFL6000 device is packaged in a very small 16-pin bump chip carrier (16-pin BCC++).

RFL6000 Device Features

- radioOne chipset eliminates receiver and transmitter IF, reducing component count, space and cost
- Two integrated LNAs with programmable gain steps
  - Cellular LNA supports CDMA
    - Operates in cellular bands in China, Japan, Korea and the United States
    - Individual gain setting for CDMA mode
  - PCS LNA supports PCS CDMA operation
    - PCS bands of operation in Latin America, Korea and the United States
    - Three CDMA gain settings
- Programmable mode control to reduce DC power consumption
- High-reverse isolation
- Efficient three-line serial bus interface (SBI)
- Low power consumption
- Fabricated in SiGe BiCMOS process
- Small package: 16-pin BCC++ (4 mm x 4 mm)

RFR6000 Device Description

The RFR6000 device is the radioOne ZIF down converter. The device has three mixers which, when combined with the RFL6000 device, provide full RF-to-baseband down conversion for the cellular, PCS and GPS band. The LO generation block produces all LO signals so that only one external single-band VCO is required for all CDMA frequency bands of operation.

Included on chip is the GPS LNA as well as the entire GPS VCO including resonant components. The Rx PLL, which resides on the transmit companion IC, the transmit device, is switched between the GPS VCO and the external Rx VCO.

Extension of standby time is achieved by selective circuit power-down, gain control and bias current. These features along with all of radioOne chipset functionalities are controlled by QUALCOMM's MSM device.

The device is designed to operate with 2.7 to 3.0 V power supplies and is compatible with single-cell Li-Ion batteries. Compatibility to the digital reference voltage (1.8 to 3.0 V) is assured when the VDDM is connected to the MSM pad voltage.

The RFR6000 device is fabricated using a SiGe BiCMOS process, which provides high-frequency, high-precision analog circuits as well as low-power CMOS functions. Package type is a 40-pin BCC++, which includes a large ground slug for improved grounding, mechanical strength and thermal conductivity.

RFR6000 Device Features

- Compatibility with QUALCOMM's radioOne ZIF chipset eliminates the entire IF, reducing component count and space
- Single- or multiband operation: cellular, PCS, GPS
- Single- or multimode operation: cellular CDMA, PCS CDMA and GPS
- Full downconversion — RF to baseband
- Receive path circuitry
  - GPS LNA
  - Stepped gain control
  - Three sets of quadrature downconverters
  - Band-specific low-pass filter
  - Baseband amplifiers with DC offset adjustment
- Only one single-band external VCO (Rx VCO) is needed for all CDMA bands of operation for entire radioOne chipset
- Includes entire on-chip GPS VCO-including resonant circuit
- Individual circuit power on/off controls
- Power reduction feature control extends handset standby time
  - Selective circuit power-down
  - Gain and bias controls
- Low-power supply voltage (2.7 to 3.0 V), low-power dissipation
  - Digital reference voltage is compatible with lower MSM voltage (1.8 to 3.0 Vdd)
- Available in small, thermally efficient package (40-pin BCC++)

MSM6150™ CHIPSET SOLUTION

RFT6100 Device Description

The RFT6100 device is a direct conversion chipset that integrates all the upconversion and modulation functionality necessary for CDMA-mode phones operating in cellular and PCS bands. This transmit chip consists of two sets of I/Q modulators, one for cellular and one for the PCS band. The baseband I/Q input from the MSM directly modulates the cellular or PCS carrier derived from the respective LO generation circuit.

Both the cellular and PCS output drive their own VGA with a gain control range of 85 dB. A final cellular driver amplifier provides a modulated RF output.

To accommodate split-band and filtering, the PCS VGA drives two output amplifiers that can be selected independently or simultaneously via an input selectable switch. All RF outputs have fully integrated 50-ohm matching networks. Integrated on the RFT6100 is the receiver phase locked loop (PLL), the transmit PLL and the entire transmit VCO including resonant components. The VCO drives the LO generation block, which in turn generates the required local-oscillator signal for all CDMA bands of operation.

RFT6100 Device Features

- Reduction in component count, space and cost via radioOne chipset that eliminates receiver and transmitter IF
- Single- or dual-band operation: cellular and PCS
- Single- or multimode operation:
  - Cellular CDMA
  - PCS CDMA
- Full direct upconversion from analog baseband to RF
- Transmit signal path:
  - Baseband amplifier
  - Two sets of quadrature modulators/upconverters
  - RF AGC amplifier, switch network, driver amplifier
- Integration of LO generation circuit
- Requirement of only one external VCO for all CDMA bands of operation
- Entire transmit synthesizer on chip (transmitter PLL and VCO)
- Receiver PLL on chip
- Greater than 85 dB transmit power control range
- Power-reduction feature via MSM control extends handset talk time
  - Optimized for low DC power consumption versus RF output level
  - Transmit puncturing
  - Selective circuit power-down
- Efficient three-line QCT SBI
- Power supply voltage (2.7 to 3.0 V)
- Small thermally efficient package (40-pin BCC++)

RFR6120/RFR6125 Device Descriptions

The RFR6120 and RFR6125 chips, optimized specifically for single-band cellular receive operation, include an integrated CDMA LNA/mixer and UHF voltage control oscillator (VCO). The RFR6125 device also includes an integrated GPS LNA/mixer and GPS VCO. The CDMA LNA performs all of the required gain, NF, IP2, IP3 and back isolation for local signal leakage. The integrated UHF VCO covers both cellular and J-CDMA bands, and is controlled by the receive (Rx) PLL integrated in the RFT6120 chip. The RFR6120 and RFR6125 chips are offered in 6 mm x 6 mm 40-pin Quad Flat No-Lead (QFN40) packages.

RFR6120/RFR6125 Device Features

- CDMA2000 1X Mobile Station Modem chipset compatibility
- Full direction down conversion — RF to baseband
- Full international cellular band operation support in Japan, China, India, Latin America, Korea and the United States
  - GPS mode/band operation support (RFR6125 only)
- Supports full international CDMA2000 1X cellular band
- Receive path circuitry (includes high dynamic range baseband filter, cellular LNA and mixer, GPS LNA and mixer (RFR6125 only), on-chip UHF VCO, on-chip GPS VCO (RFR6125 only))
- Integrated LNA with programmable gain steps
- Individual circuit power on/off controls
- Power reduction feature control extends handset standby time
  - Selective circuit power-down
  - Gain and bias controls
- QUALCOMM's efficient three-line SBI
- Low-power supply voltage (2.7 to 3.0 V)
- Digital reference voltage is compatible with lower MSM voltage (1.8 to 3.0 Vdd)
- Available in small, thermally efficient package (QFN40)

RFT6120 Device Description

The RFT6120 chip, tailored specifically for single-band cellular transmit operation, consumes lower current than its quad-mode predecessor, the RFT6100 device, and is offered in a 5 mm x 5 mm 32-pin Quad Flat No-Lead (QFN32) package.

RFT6120 Device Features

- CDMA2000 1X Mobile Station Modem chipset compatibility
- Full direction up conversion — baseband to RF
- Full international cellular band operation support in Japan, China, India, Latin America and the United States
- Supports full international CDMA2000 1X cellular band*
- Transmit path circuitry
  - Baseband amplifier
  - One set of quadrature modulators/upconverters
  - RF AGC amplifier, driver amplifier with on-chip RF matching)
- LO generation circuit integration
- On-chip transmit synthesizer (transmitter PLL and VCO)
- On-chip receiver PLL (to control UHF VCO)
- Transmit power control range greater than 85 dB
- Power reduction feature via MSM control extends handset talk time
  - Optimized for low DC power consumption versus RF output level
  - Transmit puncturing
  - Selective circuit power-down
- QUALCOMM's efficient three-line SBI
- Low-power supply voltage (2.7 to 3.0 V)
- Small, thermally efficient package (QFN32)

MSM6150™ CHIPSET SOLUTION

powerOne Series PM6650 Device Description

The MSM6150 device also interfaces directly with the first in QCT's powerOne series power management ICs, the PM6650 device. The PM6650 solution provides battery management and charging functions, including a USB charging option, and voltage regulation for the various MSM power regimes, the radioOne chipset and all other MSM-supported peripheral features. Exceptional power savings are realized through the use of a switch-mode power supply (SMPS) from the PM6650 device to regulate the MSM's core voltage. All voltages generated for the MSM and radioOne RF chips are optimized for handset system control with the MSM6150 system software.

The PM6650 chip offers unparalleled integration of power management functions for CDMA terminals, affording a tremendous savings in size and BOM for handset design. Integrated features include a color LCD backlight driver, USB OTG transceiver, R-UIM and SD card interface, PA bias control, speaker driver, real-time clock, TCXO control and various general housekeeping and interface functions — making the PM6650 chip the ideal power management solution for feature-rich terminals.

PM6650 Key Features

- Complete battery management, voltage regulation, general housekeeping and user-interface functions for CDMA terminals
- Compatibility with QUALCOMM's radioOne ZIF chipset (and all MSM-supported peripheral features)
- Trickle, fast, constant voltage and pulsed charging modes for the main battery, with current monitoring for over-current protection
- Available USB charging option with automatic charging source selection
- Complex power management, including MSM power-on sequencing and control and dynamic voltage scaling for maximum power savings
- SMPS provides high-efficiency voltage regulation for the MSM core, 1.8 V high-speed external bus interface and memory circuits
- SMPS voltage control for optimized PA Vdd and bias control for maximum talk-time performance
- SMPS voltage generation for white LEDs used for color LCD backlighting
- USB OTG transceiver
- Configurable multi-purpose pins (MPPs) for digital or analog I/O utility functions such as general-purpose LED drivers, USIM or SD-card-level translation, programmable resistors or digital switches
- High-current LED driver for camera flash application
- Speaker driver with programmable gain, turn-on time and muting; single-ended or differential operation (drives external 8-ohm speakers with volume-controlled 500 mW)
- Real-time clock for tracking time, calendar functions and programmed durations and for generating associated alarms
- TCXO control with warm-up, synchronization and buffering of the TCXO signal for optimal QPCH/catnap timing and maximum standby-time performance
- Automated power-on recovery from sudden momentary power loss
- Coin cell back-up battery support (including charging)
- 84 BCCS dual-row bump chip carrier package (7 mm x 7 mm)

The Launchpad Suite of Technologies

The Launchpad™ suite of applications technologies offers wireless operators and manufacturers a cost-effective, scalable and timely solution for providing advanced wireless data services. This seamlessly integrated solution enables advanced next-generation applications and services that incorporate multimedia, position location, connectivity, customized user interface and storage capabilities. Launchpad features are available for each QUALCOMM chipset, closely matching the specific functionality and cost-target objectives agreed upon in joint product planning with manufacturers and wireless service operators worldwide.

The MSM6150 solution supports the advanced feature set of QUALCOMM's Launchpad suite of technologies, including streaming video and audio; still-image and video encoding and decoding; 2D and 3D graphics acceleration; Java acceleration and a megapixel camera interface. The MSM6150 solution also integrates gpsOne® functionality — enabling a wide variety of location-based services and applications, including points of interest, personal navigation and friend finder.

Integrated into the MSM6150 solution are Bluetooth wireless connectivity and USB On-the-Go (OTG) host controller functionality, allowing seamless communication directly with printers, digital cameras, keyboards and other accessories.

QUALCOMM's BREW Solution

The MSM6150 includes support for QUALCOMM's BREW® solution. BREW is a complete product and business system for the development and over-the-air deployment of data services on wireless devices. The BREW system provides the necessary tools and value-added services to developers, device manufacturers and wireless operators for application development and distribution, device configuration and billing and payment.

QUALCOMM's Complete Solution — Our Commitment to Our Partners

QUALCOMM CDMA Technologies is enabling the future of communications. We work closely with our manufacturer and operator partners to develop solutions that meet market needs today and provide the technology foundation for the wireless communications of tomorrow. Our world-class CDMA engineers create detailed reference designs to accelerate testing and deployment for our partners. And our chipsets and system software are fully integrated and able to bring advanced features and functionality to today's wireless devices. With QUALCOMM CDMA Technologies, manufacturers and operators can offer sophisticated wireless solutions that succeed in the global marketplace.

* For CDMA with AMPS requirements, the RFT6100 is recommended.

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